acini. The histological appearance was closely parallel with that found in the thyroid in early cases of exophthalmic goiter. When a period of three months had elapsed between inoculation and removal of the thyroid the thyroid parenchyma showed evidence of exhausted function in that the cells were no longer swollen, their nuclei were more or less crenated and the colloid secretion within the acini was densely staining.

CONCLUSION. From the above experiments it would appear that irritation from the presence of certain bacteria within the cervical sympathetic ganglia of the goat may produce histological pictures within the ganglia and in the thyroid which parallel those found in the various stages of progressive and regressive exophthalmic goiter. This evidence supports the suggestion that in exophthalmic goiter the thyroid receives its stimulus to overfunction through its nerve supply and as a result usually of a local infection in the cervical sympathetic ganglia.

A STATISTICAL STUDY OF THE RELATIONSHIP OF THE ORIGIN OF ECTOPIC CONTRACTIONS TO VENTRICULAR PREPONDERANCE AS SHOWN BY THE ELECTROCARDIOGRAPH.[1]

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THAT the form of the electrocardiogram may indicate relative ventricular preponderance has been known for some time, but the relationship of such preponderance to the origin of ectopic contractions has, so far as we are aware, never been made a subject of study. Is it not possible that there may be some underlying relationship between preponderance and ectopic contractions that has escaped our attention up to the present?

It was with this possibility in mind that we began the review of the 375 cases studied by means of the electrocardiograph within the past eighteen months. The study was made in the cardiographic laboratory of the University of Pittsburgh, School of Medicine, at St. Francis Hospital. Most of the electrocardiograms were taken on patients who presented some cardiac disturbance, although a few were taken on patients in whom no cardiac lesion was suspected.

In the determination of preponderance we have used the criteria of Lewis,[2] slightly modified. Lewis, following the teachings of

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[1] R. B. Mellon Fellow in Internal Medicine, University of Pittsburgh, School of Medicine, Pittsburgh, Pa.

[2] Clinical Electrocardiography, Shaw & Sons, London, 1913. Observations upon Ventricular Hypertrophy, with Special Reference to Preponderance of One or Other Chamber, Heart, 1914, No. 4, v, 367–402.

Einthoven,[3] believes that those curves which show the deepest deflection in lead I and the tallest summit in lead III indicate a relative preponderance of the right ventricle. The reverse of this picture—namely, the tallest summit in lead I and the deepest in lead III—is taken by him as indicative of preponderance of the left ventricle, in which case there is a prominent *R* in the first lead accompanied by a diminutive *R* and exaggerated *S* in lead III. The modification used consisted merely in the inclusion in our statistics of those cases in which either *R* II or *S* II were greater than the corresponding waves in leads I or III, but in which consider-

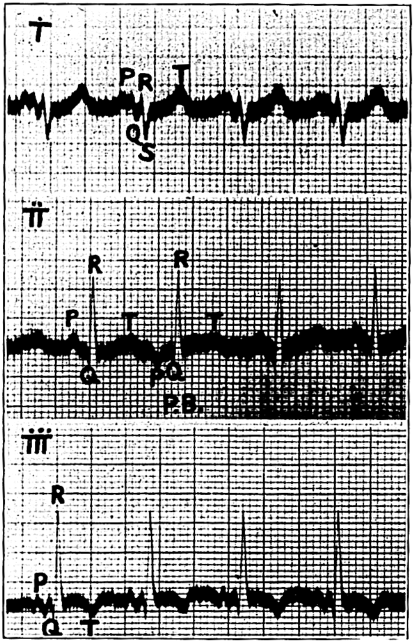

FIG. 1 (No. 289-2, leads I, II, III).—Electrocardiogram illustrating right ventricular preponderance. The *S* wave is deepest in lead I and the *R* wave is highest in lead III. This figure also illustrates a typical auricular premature contraction, in which the *P* is invert and the ventricular complex unchanged. There is no compensatory pause following the premature beat.

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[3] Arch. Internat. de Physiol., 1906, iv, 132; Arch. f. d. ges. Physiol., 1908, cxxii, 517 (quoted by Lewis).

ing leads I and III only there was a marked convergence of the *R* and *S* waves in cases of right ventricular preponderance and a marked divergence in cases of left ventricular preponderance.

Of the 375 cases studied, 136, or 36.2 per cent., showed left ventricular preponderance; 37 cases, or 9.8 per cent., showed right ventricular preponderance; while 202 cases, or 53.7 per cent., showed no relative preponderance. An apparent change in preponderance was noted in 8 cases, or 2.1 per cent., of which 2 showed a transition from left to right, or *vice versa*, 1 from right preponderance to no preponderance, or *vice versa*, and 5 from left preponderance to no preponderance, or *vice versa*.[4] Two other cases showed a doubtful

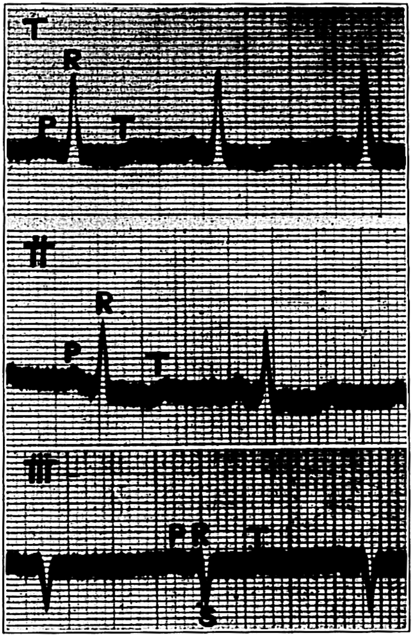

Fig. 2 (No. 359-1, leads I, II, III).—Electrocardiogram illustrating left ventricular preponderance. The *R* wave is highest in lead I and the *S* wave is deepest in lead III.

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[4] Some of these changes may have been due to change of position of the patient, as often many e'grams were made on the same case and no separate record was kept of those e'grams taken in the upright and reclining postures.

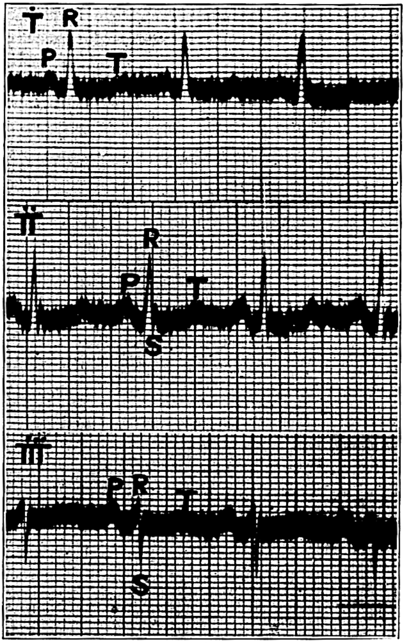

Fig. 3 (212-1, leads I, II, III).—Electrocardiogram not strictly fulfilling Lewis's criteria but representative of the type of case included in our modification as showing left ventricular preponderance. Note the *R* wave of lead II is higher than that of lead I, but the divergence of the *R* and *S* waves of leads I and III respectively is marked.

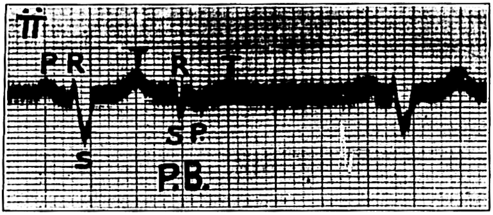

Fig. 4 (No. 210-10*a*, lead II).—Electrocardiogram illustrating a premature contraction arising in the auriculoventricular tissues. A low origin in the junctional tissues is indicated by the *R–P* sequence.

transition, but, as in the case of all figures in this paper, these doubtful cases were not included in the compilation of the statistics.

The relationship of the origin of ectopic beats[5] to ventricular preponderance forms the main theme of this study. The three types of ectopic contractions are: (1) auricular, (2) junctional and (3) ventricular. The latter may be further subdivided into those arising in the apical or left ventricular region and those arising near the base or right ventricle. We are not able at the present time to determine whether the ectopic beats arising in the auricle come from the left or right side, and although we know the relative position of beats arising in the atrioventricular tissue, that differentiation will

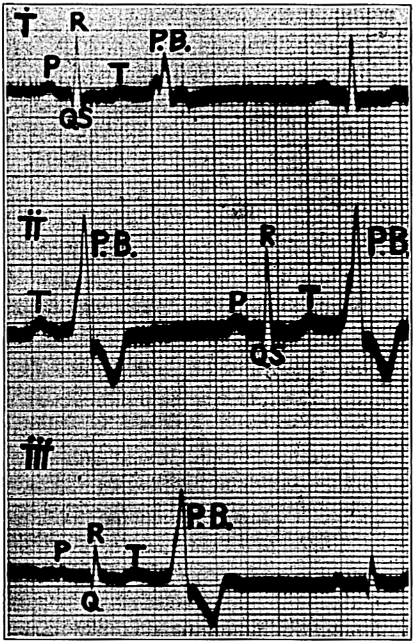

FIG. 5 (No. 149-14, leads I, II, III).—Electrocardiogram illustrating premature contractions arising in the right ventricle. The electrocardiogram also shows an absence of relative ventricular preponderance.

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[5] We use the terms ectopic and premature and contractions and beats interchangeably in this paper.

not be considered in this communication. The characteristics of the several types of premature contractions need not be repeated here, as they are thoroughly familiar to everyone acquainted with the subject of electrocardiography and others will find a simple account in Lewis's book on *Clinical Electrocardiography*. The determination of the origin of ectopic beats is usually very simple, the single difficulty often encountered being in the differentiation of ventricular beats of right and left origin when occurring only in lead 1. In but 2 instances in our series did such premature contractions occur only in lead I, and these 2 cases were of the typical form of those of left ventricular origin, and are therefore included in the study.

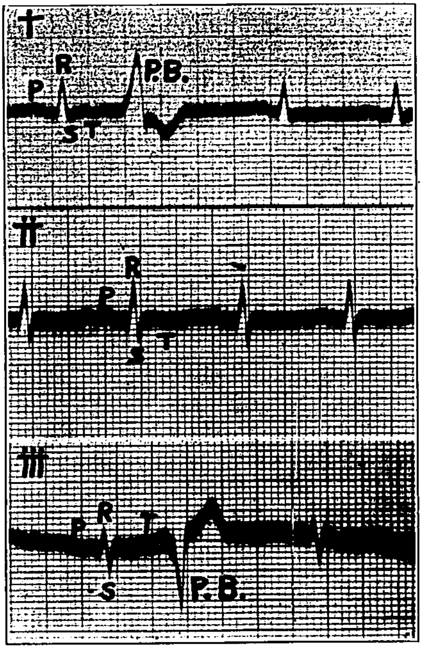

Fig. 6 (No. 130-1, leads I, II, III).—Electrocardiogram illustrating permature contractions arising in the left ventricle The premature beats are shown in leads I and III only.

Premature contractions (P. B.'s) of one type or another occurred 76 times (20.2 per cent.) in the 375 cases studied. Although it is generally stated that an individual case usually shows but one type of premature beat, we found in our series 11 cases, or 17.4 per cent., which showed two different types, of which cases 2, or 3.2 per cent., showed ectopic beats arising in three different foci. Subtracting those cases counted twice or thrice we found ectopic beats in 63 different cases, or 16.8 per cent. of the series.

TABLE I.

		Per cent.
Cases showing left ventricular preponderance	136	36.5
" right ventricular preponderance	37	9.8
" no ventricular preponderance	202	53.7
Total number of cases in series	375	100.0
Cases showing left ventricular P. B.'s	30	8.0
" right ventricular P. B.'s	25	6.6
" auricular P. B.'s	11	2.9
" junctional P. B.'s	10	2.6
Total all cases of P. B.'s	76	20.1

A glance at Table I will show that premature beats arising in the left ventricle are the most common, with right ventricular premature beats running a close second. Next in order of frequency come auricular and junctional premature contractions which, in our series, occur in almost equal number. Ectopic beats of ventricular origin arising in both apical and basilar regions together are about five times more frequent than either auricular or atrioventricular premature contractions.

Can we analyze these cases further? Is there a causative relationship between preponderance and origin of ectopic beats? In an attempt to answer that question we present the following summary:

4 cases or 2.9 per cent. of left ventricular preponderance show auricular P. B.'s
1 case or 2.7 per cent. of right ventricular preponderance show auricular P. B.'s
6 cases or 3.0 per cent. of no preponderance show auricular P. B.'s

Total 11 cases or 2.9 per cent. of all cases show auricular P. B.'s

7 cases or 5.1 per cent. of left ventricular preponderance show junctional P. B.'s
0 cases or 0.0 per cent. of right ventricular preponderance show junctional P. B.'s
3 cases or 1.5 per cent. of no preponderance show junctional P. B.'s

Total 10 cases or 2.6 per cent. of all cases show junctional P. B.'s

13 cases or 9.5 per cent. of left ventricular preponderance show right ventricular P. B.'s
4 cases or 10.8 per cent. of right ventricular preponderance show right ventricular P. B.'s
8 cases or 3.9 per cent. of no preponderance show right ventricular P. B.'s

Total 25 cases or 6.6 per cent. of all cases show right ventricular P. B.'s

18 cases or 13.2 per cent. of left ventricular preponderance show left ventricular P. B.'s
1 case or 2.7 per cent. of right ventricular preponderance show left ventricular P. B.'s
11 cases or 5.4 per cent. of no preponderance show left ventricular P. B.'s

Total 30 cases or 8.0 per cent. of all cases show left ventricular P. B.'s

But brief comment is necessary, as the summary tells its own story. Auricular premature contractions occur in practically equal proportion in all types of preponderance. A greater percentage of left ventricular preponderance show junctional premature beats. Right ventricular premature beats occur in the largest percentage in cases showing right ventricular preponderance while left ventricular premature beats occur in the largest proportion of left ventricular preponderance. As this data is based on the relative as well as the absolute proportions of these phenomena it is not unreasonable to suspect an underlying cause. A possible explanation seems to be that the hyperactivity or other abnormal conditions present in that portion of the heart that gives rise to the electrical phenomena of preponderance may likewise cause it to have an increased irritability and therefore more prone to be the seat of origin of ectopic beat formation. The series presented in this study, however, is comparatively small and the difference in relative frequency of right ventricular premature beats in cases showing right and left preponderance so little that one cannot be too cautious in drawing conclusions.

SUMMARY. In a study of 375 cases 36 per cent. showed evidence of left ventricular preponderance and 10 per cent. showed evidence of right ventricular preponderance, while 2 per cent. showed an apparent change in preponderance at different times and under varying conditions.

Premature contractions of all types occurred 76 times in the series of 375 cases (20 per cent.). In the 63 individual cases showing premature beats, 11, or 17 per cent., showed at least 2 different types while 2 cases showed origin in 3 different foci. Left ventricular premature beats were most frequent, right ventricular, auricular and junctional contractions occurring next in order in diminishing frequency.

The greatest percentage of right ventricular preponderance showed right ventricular premature contractions, while the largest percentage of left ventricular preponderance showed ectopic beats arising in the left ventricle. From these facts there is deduced a possible etiological theory to account for the relationship of preponderance and the origin of ectopic beats.

STUDIES IN CHOLELITHIASIS.

III. THE IMMEDIATE EFFECT OF THE VARIOUS TYPES OF OPERATIONS UPON THE CHOLESTERINEMIA.

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AND
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(From the Pathological Laboratory of Mount Sinai Hospital.)

IN the second paper of this series it was shown that a proper conception of the underlying pathological disturbance, initiating